Original Clinical Articles

Streptococcal Disease Control in an Ambulatory Practice

Explicit Criteria for Throat Cultures

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A throat culture protocol was implemented in an ambulatory practice to standardize culturing and to conserve laboratory resources. A retrospective chart audit during three one-month study periods preceding (1976) and following protocol implementation (1978 and 1979) showed a significant effect on care-provider compliance with culture criteria (P <.0001). During a three-year period there was a significant decrease in the number of cultures done for patients younger than 2 years of age (23.6%, 6.9% and 0%; P<.001) and asymptomatic patients (19.4%, 13.9% and 3.1%; P<.001). From 1976 to 1978 there was a 50% decrease in cultures per 100 visits (12.3 versus 6.0). This change resulted in a three-year cost savings of $79,944. Of interest was the significant increase in the percentage of positive cultures between 1977 and 1978 (12.0% versus 18.8%; P<.001). This latter finding suggests that culture protocol criteria were selective for patients with pathogens.

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The rising cost of health care has been a catalyst for a critical analysis of cost-related variables that are an integral part of health care services. In this manner, the risk of any given disease must be continually weighed against the benefits of developing programs for disease prevention, detection and treatment.

The control of streptococcal pharyngitis is a case in point. Both the low and decreasing incidence of acute rheumatic fever[1,2] and the rising cost of health care in this country give credence to concerns regarding cost-effectiveness of unselective throat culturing of large populations—that is, mass screening. Indeed, these concerns have led to the development of disease control methods that require a greater degree of selectivity in culturing specimens from persons at risk of having a group A streptococcal pharyngeal infection.

Accordingly, explicit criteria for throat culturing were implemented in an ambulatory practice for the purposes of standardizing the practice of throat culturing, targeting throat cultures to potentially culture-positive patients and effecting a cost savings by decreasing the number of throat cultures processed.

Background

The Eastside Health District facilities are located in the core city of East Denver and provide comprehensive primary care services to predominantly medically indigent patients. Four separate health facilities consisting of a health center and three peripheral stations are open at least eight hours a day, five days a week. Obstetrics, gynecology and family planning, adult medicine and pediatric services are the primary clinical services providing health care for acute episodic illnesses and chronic diseases. About 50% of all patient visits are for acute care services. During 1976 there were 83,592 clinic visits, with the number of patients seen by each clinical service as follows: adult medicine,

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41,517; pediatric services, 30,359; obstetrics and gynecology, 11,716.

Protocol Design

In the fall of 1975, a survey of clinicians at our health clinics indicated that the practice of throat culturing was unselective and inconsistent. Therefore, as a means of standardizing the use of throat cultures for diagnosing streptococcal pharyngitis, a culture protocol was designed and implemented in April 1977. The main purpose of the protocol was to decrease the use of throat cultures by establishing explicit criteria aimed at selective culturing of high-risk patients. The documented significant nationwide decline in the incidence of acute rheumatic fever[1,2] and the infrequency of proved cases of acute rheumatic fever in Denver over the previous years were rationale for discontinuing unselective screening for streptococcal pharyngitis in our clinic population.

Specific culture criteria were based on the following clinicoepidemiologic features of streptococcal pharyngitis and acute rheumatic fever:

- Acute rheumatic fever is considered to be rare in children younger than 2 years of age.[3]
- Even though symptoms of streptococcal pharyngitis vary, typical coryza (for example, rhinorrhea, conjunctivitis) is an uncommon manifestation in persons 2 years of age or older.[4,5] A survey of care providers at our health facilities indicated that the practice of throat culturing was unselective and inconsistent.
- Data from a study by Honikman and Massell[5] indicate that selective culturing of symptomatic patients with predominantly sore throat or fever of any degree would identify about 90% of potentially rheumatogenic streptococcal pharyngeal infections and substantially decrease the number of throat cultures processed.
- Data by Zimmerman and Wilson[6] suggest that selective culturing of household contacts in high-risk families is effective in identifying most pharyngeal acquisitions, a phenomenon that is directly related to the familial clustering of streptococcal pharyngitis. Based on this evidence the protocol (Table 1) was designed to selectively culture symptomatic patients or household contacts of patients with diagnosed streptococcal pharyngitis, and to prevent unselective culturing of those younger than 2 years of age and patients with afebrile coryza. The only exceptions to this selective approach were household contacts of patients with rheumatic heart disease and mass screening when there was evidence of a communitywide outbreak of streptococcal disease.

TABLE 1.—*Throat Culture Protocol*

Inclusion Criteria
Age 2 years or older
Symptoms predominantly of pharyngitis without coryza
Fever (≥38°C [100.4°F]) of undetermined cause regardless of upper respiratory tract symptoms—that is, coryza
Asymptomatic household contacts of persons with diagnosed streptococcal pharyngitis and having pharyngitis without coryza within previous 2 weeks
Asymptomatic household contacts of a family member with streptococcal pharyngitis and known rheumatic heart disease
All patients who reside in a community having epidemic streptococcal disease
Exclusion Criteria
Age younger than 2 years
Afebrile coryza
Asymptomatic patients who were not household contacts and who did not reside in a community having epidemic disease

Audit Procedures

Implementation of the protocol was completed in April 1977 by means of educational conferences for medical, nursing and laboratory staff, with periodic reinforcement in staff meetings and during orientation sessions for new personnel. A copy of the protocol was posted at each facility. Care provider compliance with protocol criteria, number of throat cultures processed and yield of throat culturing—that is, the percentage of positive cultures—were evaluated by means of a retrospective audit of patient charts and laboratory records. The chart audit was conducted by reviewing a series of charts at each facility. (One health station was excluded from tabulation due to implementation of a similar protocol in 1976.) These charts were selected from a laboratory throat culture ledger by systematic sampling: one out of ten cultured patients was audited. Three one-month periods were selected: May 1976 (precriteria), and May 1977 and 1978 (postcriteria). Charts were reviewed to identify compliance with criteria (Table 1).

Analysis of laboratory records on throat cultures resulted in one-month tabulations of the number and yield (percentage of positive cultures) of throat cultures from January 1976 through December 1979.

TABLE 2.—*Incidence of Noncompliance With Throat Culture Criteria During 1 Month Each in 1976, 1977 and 1978*

Criteria	1976 N=72 No.	1976 N=72 (%)	1977 N=72 No.	1977 N=72 (%)	1978 N=64 No.	1978 N=64 (%)	P*
Age 2 years or younger	17	(23.6)	5	(6.9)	0	(0.0)	<.0001
Afebrile coryza	10	(13.9)	9	(12.5)	14	(21.9)	.28
Asymptomatic	14	(19.4)	10	(13.9)	2	(3.1)	<.0001
TOTAL	41	(57.0)	24	(33.0)	16	(25.0)	<.0001

*2×2 χ^2 contingency table, degrees of freedom=2.

Laboratory Procedures

Throat cultures were done by vigorously wiping the posterior pharynx with two dry cotton swabs, which were then rotated across the surface of a 5% sheep blood agar plate. Plates were immediately incubated for 24 hours in an inverted position in 5% carbon dioxide at 37°C. Plates were examined twice a day for β-hemolysis, and those showing no hemolysis were reported as "negative for Beta Hemolytic Strep Group A." Those colonies showing β-hemolysis, typical morphology or catalase-negative reaction were subcultured and tested for bacitracin susceptibility. After incubation for 24 hours, observation of any zone of inhibition resulted in the following report: "Beta Hemolytic Strep, Group A by Bacitracin."

Results

In the retrospective process audit, the following charts were reviewed: 72 before protocol implementation in May 1976; 72 after protocol implementation in May 1977, and 64 in May 1978. Auditing identified a significant increase in compliance with throat culture criteria (Table 2). Over a three-year period there was a significant decrease in total number of patients inappropriately cultured ($P<.0001$). From 1976 to 1978, this decrease was predominantly due to a significant decrease in number of cultures done for patients younger than 2 years of age and asymptomatic patients ($P<.0001$), respectively. During the three study periods, 182 (87.5%) patients were symptomatic and 149 (81.9%) of these were febrile (38°C [100.4°F] or higher) or had pharyngitis without coryza. Of the 26 asymptomatic patients, only four appeared to be household contacts who demanded a throat culture; none were patients with rheumatic heart disease, and during the three years a communitywide epidemic did not occur. Protocol adherence appeared to be lasting in that the percent of noncompliance (16%) remained low in 1978.

TABLE 3.—*Annual Rate of Throat Cultures Done, 1976 Through 1979*

Year	Clinic Visits	Total No. Cultures	Cultures Per 100 Visits	P*
1976	**83,592**	**10,237**	**12.3**	
1977	84,989	7,918	9.3	<.001
1978	**83,455**	**5,030**	**6.0**	**<.001**
1979	83,107	4,669	5.6	<.001
TOTAL	335,143	27,854	8.3	

*Compared with previous year 2×2 χ^2 contingency table, degrees of freedom = 1.

TABLE 4—*Annual Incidence of Positive Throat Cultures, 1976 Through 1979*

Year	Total No. Cultures	Positive Cultures	(%)	P*
1976	**10,237**	**1,134**	**(11.1)**	
1977	7,918	948	(12.0)	.06
1978	**5,030**	**946**	**(18.8)**	**<.001**
1979	4,669	897	(19.2)	.61
TOTAL	27,854	3,925	(14.1)	

*Compared with previous year 2×2 χ^2 contingency table, degrees of freedom = 1.

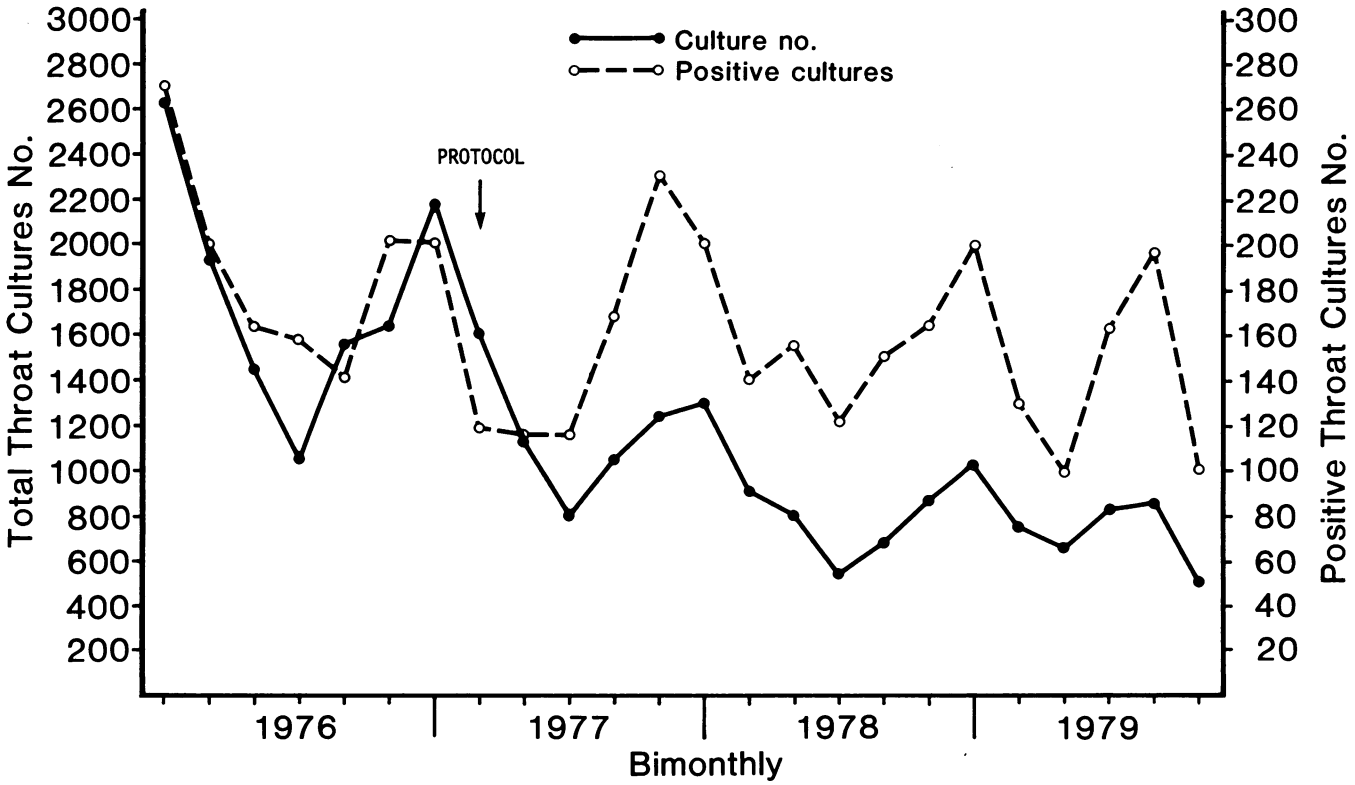

Figure 1.—Annual incidence of throat cultures and number positive, 1976 through 1979.

TABLE 5.—*Annual Cost Savings of Throat Cultures, 1976 Through 1979*

Year	Cultures		Cost*		Savings
	Expected No.	Actual No.	Expected	Actual	
1976	10,237	10,237	$ 61,422	$ 61,422	$ 0
1977	10,454	7,918	$ 62,724	$ 47,508	$15,216
1978	10,265	5,030	$ 61,590	$ 30,180	$31,410
1979	10,222	4,669	$ 61,332	$ 28,014	$33,318
TOTAL	41,178	27,854	$247,068	$167,124	$79,944

*$6 per culture, based on 1976 laboratory charge for processing throat cultures.

The laboratory audit showed a pronounced and continual decrease in total cultures done after protocol implementation, and a concurrent decrease in number of cultures positive for group A streptococcal pharyngitis (Figure 1). However, there was a corresponding rise in the ratio of positive cultures to total cultures. Since 1976, there was a significant decrease in the annual rate of throat cultures per clinic visits ($P<.001$) (Table 3). With the exception of 1976 to 1977, there was minimal change in the absolute number of positive cultures each year (Table 4). This is to be contrasted with a significant increase in percent of positive cultures from 1977 to 1978 ($P<.001$). Furthermore, based on a 1976 cost of $6 per throat culture (charge for processing cultures) and a culture rate of 12.3 per 100 visits, protocol implementation resulted in a total cost saving of $79,944 when costs for expected versus actual number of cultures per year were compared (Table 5). Cost per positive culture decreased from $54 in 1977 (precriteria) to $31 in 1979 (postcriteria); these figures are based on the assumption that laboratory charges and cost were the same.

Comments

Standardization of care has been effected in select areas of medical care by creating explicit procedural criteria that are designed to improve diagnostic accuracy and therapeutic efficacy. In this regard, prevention of acute rheumatic fever, which is contingent on early and definitive treatment of group A streptococcal pharyngitis, is amenable to standardization in that throat cultures remain the only practicable diagnostic method of providing bacteriologic evidence of infection. With this in mind, the development of explicit criteria governing the use of throat cultures is basic to a uniform approach to streptococcal disease control.

The decision for which patients cultures are to be done has historically been fraught with confusion and controversy, albeit, from a simplistic view, there are ostensibly only three options: not to culture in any case regardless of symptoms; to culture in every case regardless of symptoms, or to culture in select cases based on clinical and epidemiologic risk factors. One approach to deciding which option is most appropriate at any given time and with any given population was described in an article by Tompkins and coworkers.[7] Based on a decision-analysis method, the cost-effectiveness of intervention strategies for managing pharyngitis was directly related to population rates of streptococcal pharyngitis. For epidemic streptococcal pharyngitis associated with positive throat culture rates of 20% or higher, treatment without throat cultures is warranted. For endemic disease with culture rates of less than 20%, two other strategies were recommended: for rates less than 5%, throat cultures and treatment are unnecessary; for rates between 5% and 20%, treatment is based on throat culture results.

Because there exist regional and population variations in the epidemiology of streptococcal disease, the approach to acute rheumatic fever prevention must be individualized. Based on current epidemiologic trends in this country, reliance on throat cultures to detect group A streptococcal pharyngitis appears to be the most widely useful and cost-effective. With unacceptable rates of acute rheumatic fever in select groups (military recruits, impoverished communities and so forth) and rates of streptococcal pharyngitis averaging higher than 5% in many school-aged children, discontinuation of disease control methods—that is, throat cultures—is unwarranted. However, current epidemiologic trends of streptococcal disease and acute rheumatic fever also indicate that methods designed to curtail epidemic disease, be it culturing independent of symptoms or treatment independent of culture results, are becoming less applicable.

Because symptoms of upper respiratory tract infection are extremely variable and in 90% of cases due to a viral infection, the unselective culturing of specimens from patients with such symptoms will still result in many unnecessary cultures. This problem could possibly be mitigated if there were clinical or epidemiologic markers identifying those at greatest risk of having a streptococcal pharyngeal infection.

Although findings of previous studies have led to the conclusion that symptoms are poor indicators of streptococcal infections,[8] Honikman and Massell have provided some useful clinical guidelines for doing cultures.[5] Results of their study—which consisted of a 14-year clinical, bacteriologic and serologic survey of school-age children—showed that doing throat cultures only in cases of patients with predominantly sore throat or fever (38°C or higher) regardless of symptoms resulted in a 70% decrease in number of cultures processed, detected 88% of all immunologically confirmed infections, and increased the percentage of positive

cultures by 17%. In addition, the findings from two studies by Zimmerman and Wilson[6] suggested that select epidemiologic variables also accurately identify those at risk for streptococcal infections. In a bacteriologic and serologic survey of household contacts, Zimmerman suggested that certain families were highly susceptible to streptococcal pharyngitis, and the members of these families had recurrent infections and accounted for 53% to 91% of all streptococcal acquisitions. Targeting throat cultures to these families decreased by 50% to 60% the total number of cultures processed.

Based on this information an explicit protocol for doing cultures was implemented in a comprehensive ambulatory practice as a means of standardizing the use of throat cultures and decreasing both numbers of cultures processed and laboratory cost. The protocol limited the use of throat cultures to patients who had specific upper respiratory tract symptoms or epidemiologic risk factors. A retrospective chart audit of degree of adherence to protocol criteria and a prospective laboratory survey were carried out to identify the protocol's effects on the rate of throat cultures, disease detection rate and laboratory cost. The results of both surveys showed the following: (1) over a two-year period there was an overall significant increase in compliance with protocol criteria as identified by a 32% decrease in cases in which cultures were inappropriately done ($P<.0001$). The predominant decrease in the number of cultures was in asymptomatic patients and those younger than 2 years of age (Table 2): the continued use of cultures in patients with afebrile coryza may have been due to difficulties in distinguishing this upper respiratory tract infection symptom complex from predominantly pharyngitis; (2) adherence to the protocol resulted in a significant decrease ($P<.0001$) in the number of cultures per clinic visit (Table 3); (3) although there was a minimal change in the number of positive cultures, the decreased rate of culturing did not appear to significantly affect disease detection. This is indicated by the significant ($P<.001$) increase in the percentage of cultures positive for group A streptococcal pharyngitis two years following protocol implementation (Figure 1, Table 4) and is evidence that culture criteria were effective in eliminating some potentially culture-negative patients; (4) the most impressive result of protocol use was a laboratory cost savings of $79,944 (Table 4), with a substantial decrease in cost per positive culture. Noteworthy was the fact that during this four-year period (1976 through 1979), not a single case of documented acute rheumatic fever occurred in our clinic population.

These results and the foregoing discussion are testimony to the importance of using disease control methods that are based on epidemiologic trends and health care cost. In this regard, the overall low and decreasing incidence of acute rheumatic fever in this country is rationale for selectively doing throat cultures to detect group A streptococcal pharyngitis.

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